

We claim:

- 5 1. A process for preparing high-functionality polyisocyanates, which comprises
- 10 (i) preparation of an addition product (A) which contains one group which is reactive toward isocyanate and at least two isocyanate groups by reacting
- 15 (a) a diisocyanate or polyisocyanate I with
- (b1) compounds having at least three groups which are reactive toward isocyanate or
- (b2) compounds containing two groups which are reactive toward isocyanate or mixtures of (b1) and (b2),
- 20 where at least one of the components (a) or (b) has functional groups having differing reactivities toward the functional groups of the other component and the reaction ratio is selected so that the addition product (A) contains an average of one group which is reactive toward isocyanate,
- 25 (ii) if desired, intermolecular addition reaction of the addition product (A) to form a polyaddition product (P) containing an average of one group which is reactive toward isocyanate and an average of more than two isocyanate groups, and
- 30 (iii) reaction of the addition product (A) and/or the polyaddition product (P) with a diisocyanate or polyisocyanate II.
- 35 2. A process as claimed in claim 1, wherein the diisocyanate or polyisocyanate I is different from the diisocyanate or polyisocyanate II.
- 40 3. A process as claimed in claim 1 or 2, wherein the diisocyanate or polyisocyanate I used is tetramethylene diisocyanate, tetramethylene diisocyanate trimer, hexamethylene diisocyanate, hexamethylene diisocyanate trimer, dodecyl diisocyanate, isophorone diisocyanate trimer, 4-isocyanatomethyloctamethylene 1,8-diisocyanate,
- 45 diphenylmethane 4,4'-diisocyanate or a mixture thereof.

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4. A process as claimed in claim 1 or 2, wherein the diisocyanate or polyisocyanate I has isocyanate groups of differing reactivity and is selected from among tolylene 2,4-diisocyanate, tolylene 2,6-diisocyanate, diphenylmethane 2,4'-diisocyanate, phenylene 1,3- and 1,4-diisocyanate, naphthylene 1,5-diisocyanate, tolidine diisocyanate, triisocyanatotoluene, biphenyl diisocyanate, isophorone diisocyanate, 2-butyl-2-ethylpentamethylene diisocyanate, 2-isocyanatopropylcyclohexyl isocyanate, 3(4)-isocyanatomethyl-1-methylcyclohexyl isocyanate, 1,4-diisocyanato-4-methylpentane, 4-methylcyclohexane 1,3-diisocyanate, dicyclohexylmethane 2,4'-diisocyanate and mixtures thereof.
5. A process as claimed in any of claims 1 to 4, wherein the diisocyanate or polyisocyanate II is selected from among tolylene 2,4-diisocyanate, tolylene 2,6-diisocyanate, diphenylmethane 4,4'-diisocyanate, diphenylmethane 2,4'-diisocyanate, higher homologues of diphenylmethane diisocyanate, naphthylene 1,5-diisocyanate, tolidine diisocyanate, phenylene 1,3- and 1,4-diisocyanate, triisocyanatotoluene, biphenyl diisocyanate, tetramethylene diisocyanate, hexamethylene diisocyanate, dodecyl diisocyanate, lysine alkyl ester diisocyanate, where alkyl is C<sub>1</sub>-C<sub>10</sub>-alkyl, isophorone diisocyanate, 2-methylpentamethylene diisocyanate, 2,2,4- or 2,4,4-trimethylhexamethylene 1,6-diisocyanate, 1,3- and 1,4-diisocyanatocyclohexane, 3(4)-isocyanatomethyl-1-methyl-1-isocyanatocyclohexane, 2-butyl-2-ethylpentamethylene diisocyanate, 4-isocyanatomethyloctamethylene 1,8-diisocyanate, 2-isocyanatopropylcyclohexyl isocyanate, 2- or 4-methylcyclohexane 1,3-diisocyanate, dicyclohexylmethane 4,4'- and 2,4'-diisocyanate, 1,3- or 1,4-bis(isocyanatomethyl)cyclohexane, xylylene diisocyanate, tetramethylxylylene diisocyanate and oligoisocyanates or polyisocyanates prepared from the isocyanates listed by coupling by means of urethane, allophanate, urea, biuret, uretdione, amide, isocyanurate, carbodiimide, uretonimine, oxadiazinetriene or iminooxadiazinedione structures, or from among mixtures of the isocyanates mentioned.
6. A process as claimed in any of claims 1 to 5, wherein, in the reaction of the addition product (A) and/or the polyaddition product (P) with the diisocyanate or polyisocyanate II, the ratio of isocyanate groups of the diisocyanate or polyisocyanate II to the isocyanate-reactive groups of the addition product (A) and/or the polyaddition product (P) is

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selected so that at least 10%, preferably at least 40%, of the NCO groups of the diisocyanate or polyisocyanate II are reacted.

- 5 7. A process as claimed in any of claims 1 to 6, wherein the isocyanate-reactive groups of the components (b1) and/or (b2) are selected from among hydroxyl groups, mercapto groups, amino groups and mixtures thereof.
- 10 8. A process as claimed in any of claims 1 to 7, wherein the diisocyanate or polyisocyanate I used is isophorone diisocyanate, isophorone diisocyanate trimer, tolylene 2,4-diisocyanate or diphenylmethane 2,4'-diisocyanate and the diisocyanate or polyisocyanate II used is hexamethylene diisocyanate, a hexamethylene diisocyanate oligomer mixture, 15 diphenylmethane 4,4'-diisocyanate, diphenylmethane 2,4'-diisocyanate, a mixture of diphenylmethane diisocyanates and higher homologues of diphenylmethane diisocyanate (polymeric MDI) or a mixture of the isocyanates listed.
- 20 9. A process as claimed in any of claims 1 to 8, wherein the compounds (b1) having groups which are reactive toward isocyanate are glycerol, trimethylolmethane, trimethylolethane, trimethylolpropane, 1,2,4-butanetriol, 25 tris(hydroxymethyl)aminomethane, tris(hydroxyethyl)aminomethane, 2-amino-1,3-propanediol, 2-amino-2-methyl-1,3-propanediol, diethanolamine, dipropanolamine, diisopropanolamine, ethanolpropanolamine, bis(aminoethyl)amine, bis(aminopropyl)amine, 30 tris(aminoethyl)amine, tris(aminopropyl)amine, trisaminononane, pentaerythritol, bis(trimethylolpropane), trifunctional or tetrafunctional polyetherols or polyesterols and the compounds (b2) used are ethylene glycol, diethylene glycol, triethylene glycol, 1,2- and 1,3-propanediol, 35 dipropylene glycol, tripropylene glycol, neopentyl glycol, 1,2-, 1,3- and 1,4-butanediol, 1,2-, 1,3- and 1,5-pentanediol, hexanediol, propane-1,2-dithiol, butane-1,2-dithiol, mercaptoethanol, mercaptopropanol, mercaptobutanol, ethylenediamine, tolylenediamine, isophoronediamine, 40 cysteamine, ethanolamine, N-methylethanolamine, propanolamine, isopropanolamine, 2-(butylamino)ethanol, 2-(cyclohexylamino)ethanol, 2-amino-1-butanol, 2-(2'-aminoethoxy)ethanol or higher alkoxylation products of ammonia, 4-hydroxypiperidine, 1-hydroxyethylpiperazine, 45 aminopropanethiol or bifunctional polyetherols or polyesterols.

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10. A high-functionality polyisocyanate, which can be prepared as claimed in any of claims 1 to 9.
11. A high-functionality polyisocyanate which can be prepared as claimed in any of claims 1 to 9 and has both aliphatically bound and aromatically bound isocyanate groups.
12. The use of a polyisocyanate as claimed in claim 10 or 11 for producing paints and varnishes, coatings, adhesives, sealants, pourable elastomers and/or foams.
13. A polyaddition product obtainable using a high-functionality polyisocyanate as claimed in claim 10 or 11.

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